CEC Workshop on Renewable Distributed Generation

Black & Veatch

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Overview of Comments

- Introduction to Black & Veatch
- Solar Photovoltaics
  - Reliability/Life
  - Capacity/Efficiency (Losses)
  - Cost
- Palmdale Water District RE DG Projects
  - Solar
  - Hydro
  - Wind

Black & Veatch: Introduction

- Global consulting, engineering, and construction firm
- $2 billion in annual revenues
- Specialize in three sectors: Energy, Water, and Information
- 40 Staff Working on All Aspects of Renewable Energy Worldwide
- 6 California Offices
- Working with California Clients on Renewable Energy Projects from several kW to 120 MW Pine Tree Wind Project

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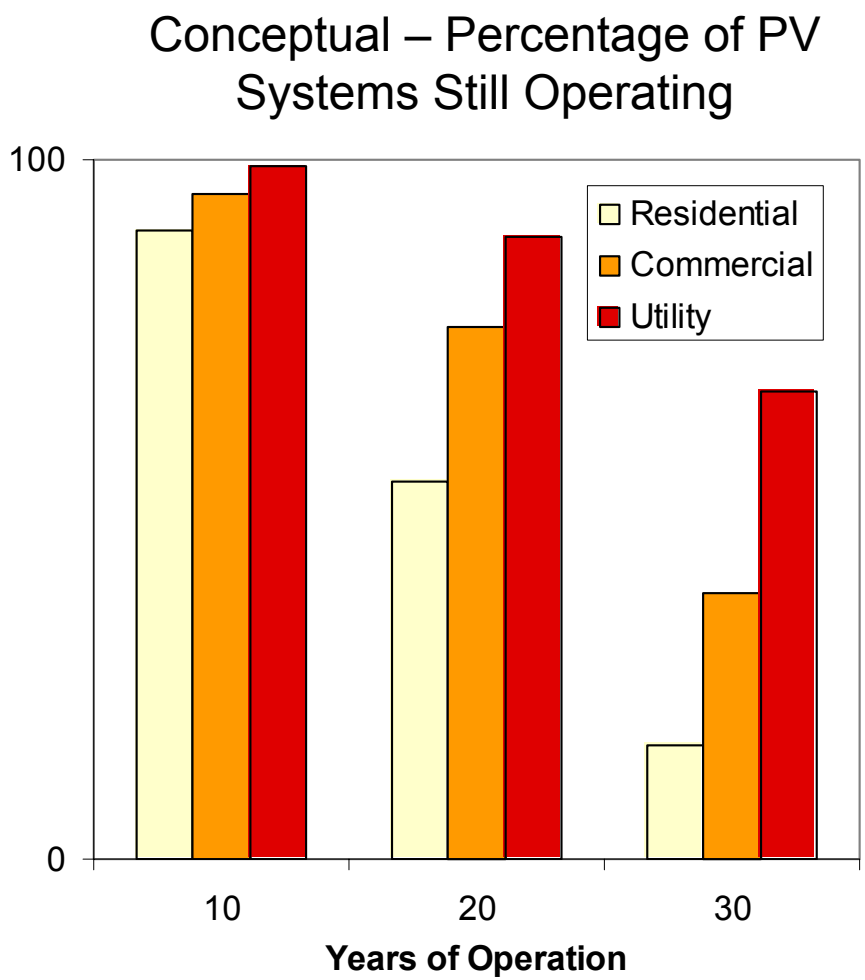
Solar PV: Reliability/Life

- PV Module Life/Warranties Quite Good (20+ Year Warranties Common)
- Inverter Reliability/Life Needs Improvement
- Host Issues Very Important for Longevity – Especially Residential
- Not Every System Will Operate 20 Years—Or Even 10 Years

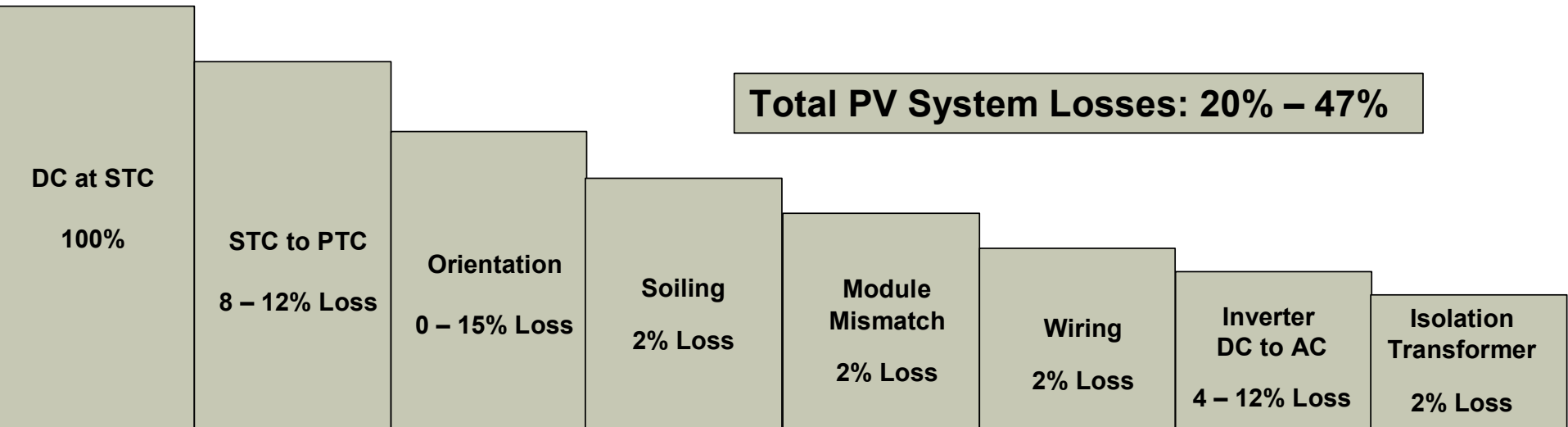


Solar PV: Reliability/Life Needs

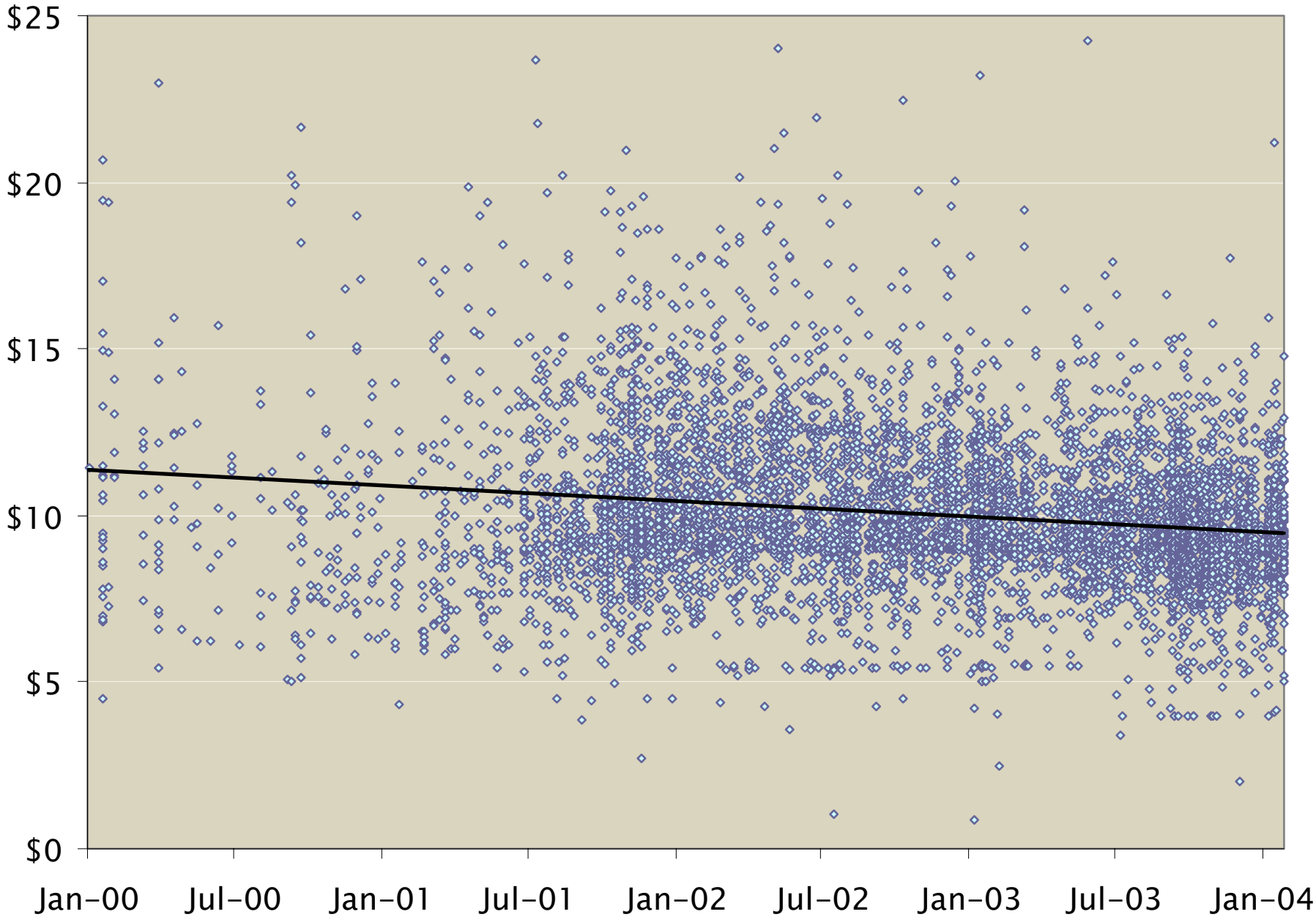
- Goal: 20-Year Life with Affordable, Available Maintenance
- Practice: Qualified Suppliers, Installers, Maintenance Personnel
- Policy: Structured to Support Long Life Operation

Solar PV:
System Efficiency/Capacity

- System Efficiency/Capacity Can Vary Greatly Depending on Components/Design Configuration
- Incentives Should Encourage Design and Installation Enhancing Annual AC Output



Price of Completed Solar PV Systems Under CEC Incentive Program ($/Watt)



Source: CEC Website: 2004-01-28_CMPLETED_SYSTEMS.xls

Palmdale Water District (PWD) Experience with RE DG

- Peak Load: 5.6 MW
- California “Power Crisis” of 2000 / 2001
  - Rolling Blackouts
  - Power Costs Driven Up Over 30%
- Desire to Lower Rates, Isolation from Price Spikes, Self-Sufficiency
  - Hired Black & Veatch to Assist with Consulting, Engineering and Project Management
  - Implementing Numerous Self-Generation Projects

Solar Photovoltaic Project

- 30 kW, 22% Capacity Factor, 58,000 kWh/year
- Incentives: Net metered, Self-Generation Incentive Program (SGIP)
- Bid, permitted, and operational in less than one year (January 2003)

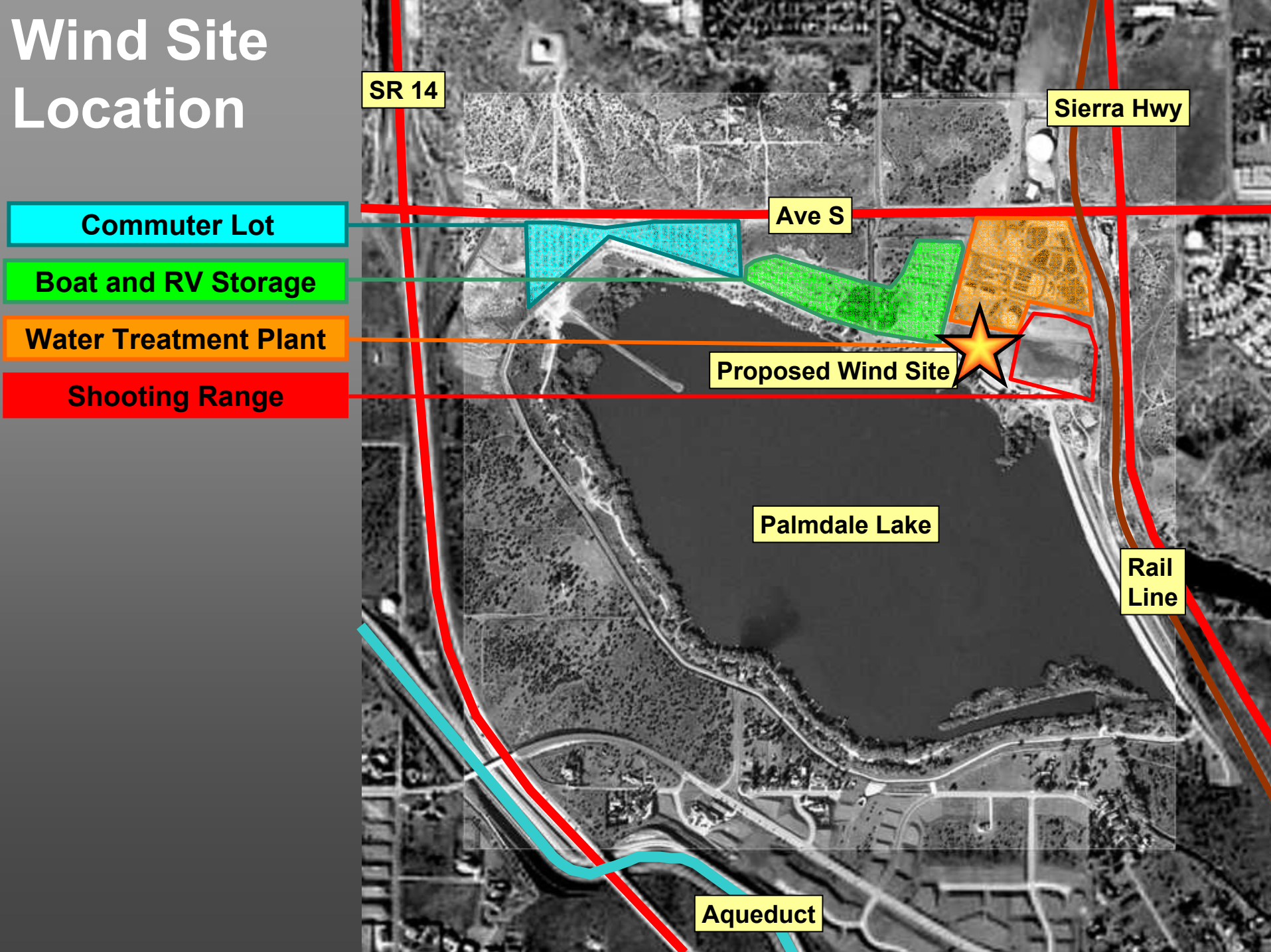
Hydro Project

- 244 kW, 40% Capacity Factor
- Located on conduit between California Aqueduct and Lake Palmdale
- Replaces pressure reduction valve and recovers wasted energy
- New 0.75-mile distribution line being constructed to deliver power to PWD load center
- Projected to be complete in 2005
- No incentives utilized for the project

Wind Project

- Single NEG Micon NM54 950 kW Wind Turbine
- Location:
  - Edge of Palmdale (Commuter City for LA)
  - Sited at Largest PWD Load Center
  - Moderate Wind Resource (Class 3-4)
- Key Incentives
  - Net Metering (Largest Wind Project in California)
  - Self-Generation Incentive - $1,000,000 rebate from SCE
- Much More Difficult Than Solar PV
  - Public Acceptance Split, NIMBY Issues
  - City of Palmdale Filed Lawsuit over Mitigated Negative Declaration

Wind Site Location



Visual Simulations of Wind Project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Current Status

Project Summaries

	Solar PV	Wind Turbine	Hydro
Size, kW_{AC}	30	950	244
Total Project Cost	$300,000	$2,000,000	$1,050,000
Capital Cost Rebate	$135,000	$1,000,000	N/A
Total Cost After Rebate, $/kW	$5,500	$1,050	$4,300
Capacity Factor	22%	22%	40%
Generation, MWh/yr	58	1,800	900
Power Value, ¢/kWh	12	7	12
Payback Period, yr	~20	~10	~10-14

Future Activities

- Complete Wind and Hydro Projects
- Demonstrate New Energy Storage Technology in a MicroGrid Arrangement
  - Ultracapacitor “Energy Bridge”
  - Integrate Energy Storage, Loads, Wind, Hydro, and Engine Generators
  - California Energy Commission Funded
  - Under Negotiation

Lessons Learned

- California Very Good For Renewable DG Projects
- Active Coordination with Utility is Essential (Self-Gen Incentive, Net Metering, Interconnection, Distribution System Modifications, etc.)
- Economics of Renewable Resources Varies Substantially
- Wind Resource Important, but Not Key
- Public Outreach and Environmental Review for Wind Projects are Very Important
- Excellent Potential to Replicate this Project at Other Sites

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